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TECHNICAL NEWS BULLETIN
OF THE BUREAU OF STANDARDS

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SPECTROSCOPIC LABORATORY AND EQUIPMENT

The facilities of the bureau for spectroscopic research have been enlarged by providing additional space and complete equipment for the study of spectral lines excited in a magnetic field (Zeeman effect). The space consists of three connected basement rooms, the first contains a power plant, the second contains various spectroscopic sources and a large electromagnet, and in the third provision is made for the installation of the bureau's largest spectrographs. The main item of the power plant is a 20 kw. motor generator, set to supply the electromagnet with 200 amperes of current at a potential of 100 volts. The electromagnet is suitable for the investigation of Zeeman effects in fields up to 50,000 gausses per square centimeter. This magnet is mounted on a truck so that it may be moved and used in conjunction with any one of the three different spectographs mounted in the adjoining room, or it may be pushed to one side and any other type of spectrum source (for example, arc in air, vacuum arc, high-potential condensed spark, Geissler tube) may be substituted and studied with any of the spectrographs. These last consist of a conclave grating, a plane grating, and a quartz prism spectrograph. The concave grating has 640 centimeter radius of curvature and about 70,000 useful lines. It is mounted in parallel light with the aid of an auxiliary mirror, and the spectra are photographed on long strips of thin photographic plates clamped to steel rails carefully adjusted to lie in the focal curve. A spectral range extending from 2,200 A in the first order to 4,500 A in the fourth order is thus covered by this instrument. The plane grating is provided with collimator and camera lenses of 6 inches aperture and 16 feet focal length; they were made in the bureau's shops from glass, which was melted, molded, and annealed in the optical-glass laboratory. The quartz spectrograph is one of the largest types made; it is used mainly to extend observations in the ultra-violet to about 1,900 A. In addition to the study of Zeeman effects for the purpose of classifying the spectral lines, thus identifying spectral

terms and describing the atomic energy states involved in the emission of the lines, these spectrographs will be useful in obtaining more accurate descriptions than those now available for various emission spectra, and their relatively high resolving powers adapt them also to investigations of the complex structure of certain lines.

PHOTOGRAPHIC EMULSION INVESTIGATIONS

A laboratory for the investigation of the photographic emulsion has developed as an outgrowth of the work of the bureau on color sensitivity in its scientific applications, particularly to spectroscopy. Two more papers on color sensitization have been published during the past two years; they deal with sensitization for the entire visible spectrum by one bath and sensitization for a reversal process by desensitizers. Further studies on the mechanism of sensitization and hypersensitization are in progress. It has been found advisable, as a foundation for practical improvements, such as better color sensitivity, to attempt a study of fundamental factors in the preparation of the emulsion. Emulsion making has for various reasons been a highly secret empirical art for over a generation. Reliable data of a quantitative or systematic nature are almost entirely lacking, and the variables are so numerous that much preliminary work has been necessary before the study of any single variable could be undertaken with any confidence that the observed effects could be correlated with the variations deliberately introduced.

The first paper of the intended series ("The photographic emulsion: I, comparison of emulsions made with different bromides," Journal Physical Chemistry, Vol. 31, p. 906; 1927) has just appeared. Its main interest lies in the correlation of the observed photographic differences with the physical and chemical properties of solutions of the different bromides, such as their solvent power for silver bromide and their tendency to form complex ions with ammonia, both of which affect the precipitation and growth of the sensitive silver bromide grains.

EFFECT OF REPEATED STRESS ON MAGNETIC PROPERTIES

An investigation on the effect of repeated stress on the magnetic properties of steel is under way, and a paper on the preliminary phases of the subject is in preparation.

It is known that the application of static axial stresses below the elastic limit do not produce a permanent change in magnetic properties after removal of the stress. The results of the present investigation show, however, that repeated bending, such as occurs in the usual rotating beam fatigue test, results in easily measurable changes in magnetic permeability. The changes take place most rapidly in the early part of the test and proceed at a decreasing rate as the test is continued. It has been found that five cycles of stress are sufficient to bring about a measurable magnetic change. The magnitude of the magnetic change depends upon the intensity of the stress and the number of repetitions.

Analysis of the data so far obtained on a single type of steel indicates that the change in magnetic permeability produced by repeated bending is of the same nature as that resulting from the relieval of a compressive stress. This change is probably caused by redistribution of internal stress.

This investigation is being continued, as it now appears very probable that by this method of investigation much can be learned of the fatigue of metals that could be learned in no other way.

THERMAL EXPANSION EQUIPMENT

The bureau has received numerous requests for a description of thermal expansion equipment less expensive than that described some months ago. There are many instances where data of highest precision are not demanded and when time and effort can be spared by using an equipment recently assembled at the bureau.

This type has been used in European laboratories for a number of years. Slight modifications have been made by the bureau. A fused quartz tube about 50 cm long and 2 cm in diameter is closed at one end. The specimen to be tested should be about 20 cm. long and is placed in the tube. On top of the specimen is placed a fused quartz rod sufficiently long to reach to the open end of the tube. An indicator gauge is fastened to the top of the tube and registers the relative motion between the tube containing the specimen and rod resting on the specimen. The bottoms of the tube and rod are ground concave and the ends of the specimen convex to secure satisfactory contacts. Heating is effected by placing the tube and sample in a water or oil bath or electrical furnace extending well above the top of the specimen. Low temperatures are secured by using proper cooling baths. A thermocouple placed inside the fused quartz tube near the sample indicates the temperature. The average coefficient of expansion of fused quartz (0.0000005 per degree C.) should be added to the expansivity coefficient secured from this equipment.

A complete description of the apparatus and a comparison of results obtained with this equipment and other types of expansion equipment which the bureau is now testing will be published later.

Photographs showing the general plan of the fused quartz tube expansion device are available for those wishing to install this type of equipment.

Tests indicate an accuracy of better than 2 per cent in the value of the coefficient for ordinary materials.

FIFTH ANNUAL CONFERENCE OF STATE PUBLIC UTILITY COMMISSION ENGINEERS

The regular 1927 conference of engineers of State untility commissions was held at the bureau on June 2 and 3. It was even more widely attended than preceding sessions, having representatives from the States of Alabama, California, Florida, Idaho, Illinois, Iowa, Maryland, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, South Carolina, Wisconsin, West Virginia, the District of Columbia, and the Province of Ontario. This conference affords an excellent opportunity for the interchange of experience on problems of common interest to the different States, and in order to make it as useful as possible for this purpose invitations are limited to the technical staffs of the State commissions.

The program of the session included paper on "Determination of depreciation," by James Imboden, chief engineer of the West Virginia Commission; "One-man street cars," by C. M. Larson, chief engineer of the Wisconsin Railroad Commission; "Electric laboratory of New York Public Service Commission," by R. H. Nexsen, deputy chief engineer of the New York Public Service Commission; "Voltage regulation on primary and secondary circuits," by George Charlesworth, electrical engineer, Board of Railroad Commissioners of Iowa; "A rational combined rate for residential service, applicable either to gas or electricity," by Ray Y. Gildea, service engineer, Maryland Public Service Commission; "Coordination between States," by A. B. Greene, telephone engineer, Florida Railroad Commission; "A rational determination of the cost of making distribution extensions and service connections," by A. E. Davison, assistant engineer, Hydroelectric Power Commission of Ontario. A part of one session was devoted also to discussion of the development and potential value of water powers in view of the reduced cost of steam generation of power. Since these subjects were discussed from the point of view of utility regulation and the problems of the commissions rather than in their more general bearings, the proceedings of the conference will not be published. Some of the papers, however, will be printed in the technical press.

Arrangements for these annual conferences are made by a committee of the engineers. For the coming year the membership of this committee will be

I. F. McDonnell, of Alabama, chairman; George Charlesworth, of Iowa; A. G. Mott, of California; and C. R. Vanneman, of New York; the Bureau of Standards providing secretarial service for the committee.

SIMPLIFICATION OF PORCELAIN INSULATORS

A simplified practice recommendation covering varieties of one-piece porcelain insulators was adopted by a general conference of representatives of the industry, held under the joint auspices of the National Committee on Metals Utilization and the division of simplified practice on June 3. This program provides for a total reduction from 272 varieties to 210, corresponding to an elimination of 22.4 per cent. The conferees were of the opinion that the consistent adherence of all concerned to this program would produce an annual saving of approximately $400,000.

SIMPLIFICATION OF RANGE BOILERS

The first revision of Simplified Practice Recommendation No. 8 for range boilers and expansion tanks was discussed at a revision conference held under the auspices of the division of simplified practice on May 3. A survey showing the extent of adherence to the standard sizes and capacities of both range boilers and expansion tanks was used as a basis for discussion by the conferees. The degree of adherence to the standard schedule for range boilers being 99 and for expansion tanks 88 per cent. It was the consensus of opinion that no further eliminations or additions should be made to the standards already in effect. It was unanimously voted that the present simplified practice recommendation be reaffirmed for another year, effective May 1, 1927, subject to consideration and revision by a similar meeting.

SIMPLIFICATION IN THE BEARING INDUSTRY

The step in simplification recently taken by a well-known firm of bearing manufacturers is worthy of mention as a striking example of how an individual company can apply the principles of simplified practice to its product.

This company in reducing the number of sizes of bearings which it produces from 572 to 455, or better than 20 per cent, has divided its bearings into three groups—preferred, nonpreferred, and service. In the preferred list are included those sizes which will be recommended and on which sales effort will be concentrated. Those sizes which are to be discouraged, and of which only a limited quantity will be carried in stock, are grouped in the nonpreferred list. In the service list is included those sizes not recommended and which it is hoped can ultimately be discontinued. Only a minimum number will be stocked. This manufacturer goes further and points out in its catalogue the advantages which should accrue to all interests as the result of adherence to this simplification program.

MANAGEMENT WEEK, 1927

The theme for Management Week, October 24 to 29, 1927, "Management's Part in Maintaining Prosperity," is already attracting nation-wide attention, particularly among those concerned with management problems, and progress is being made in organizing local committees to sponsor management week programs.

Organizers are at work to make Management Week a success in the following cities: Birmingham, Ala.; Los Angeles, Oakland, and San Francisco, Calif.; New Haven, Conn.; Rockford, Ill.; Lafayette, Attica, Brazil, Clinton, Elkhart, Gas City, Indianapolis, Kentland, Kokomo, La Grange County, Linton, Logansport, Matthews, Muncie, Plymouth, Redkey, Rochester, and Veedersburg, Ind.; Des Moines, Iowa; Springfield and Uxbridge, Mass.; Muskegon, Mich.; Minneapolis, Minn.; Lincoln, Nebr.; East Orange and Elizabeth, N. J.; Schenectady and Utica, N. Y.; Cleveland, Columbus, and Dayton, Ohio; Tulsa, Okla.; and Erie, Pa. Chairmen

have been selected for Indianapolis, Ind.; Rochester, N. Y.; and Columbus, Ohio. Secretaries have been appointed for Elizabeth, N. J., and Rochester, N. Y.

Executives of every kind—corporation presidents, plant managers, engineers, accountants, comptrollers, purchasing agents, sales managers, shop foremen, credit managers, merchants, and others—who have any responsibility for the efficient and profitable operation of American business enterprises should find in this program an opportunity to demonstrate from their own experiences what policies, procedures, and practices will help most to hold our prosperity at its present high level.

All individuals and organizations interested in the solution of management problems should take an active part in Management Week, 1927. To this end it is suggested that they communicate with the national secretary, Ray M. Hudson, chief, division of simplified practice, Department of Commerce, Washington, D. C., who will put them in touch with the local committees in their respective cities and furnish such general information as may be necessary. The 1927 manual is available for distribution and may be had upon request to the national secretary.

The sponsor societies and their representatives on the national committee are as follows: Honorary chairman, A. W. Shaw, president A. W. Shaw Publishing Co.; chairman, Cecil S. Ashdown, American Institute of Cost Accountants; members, Park T. Sowden, American Society of Mechanical Engineers; C. C. Barnum, Taylor Society; T. D. Nevins, Society of Industrial Engineers; R. W. Sparks, American Management Association; W. L. Chandler, National Association of Purchasing Agents; E. H. Tingley, National Association of Foremen; F. L. Rowland, Life Office Management Association; O. G. Sherman, National Association of Office Managers; secretary and treasurer, Ray M. Hudson, chief division of simplified practice, United States Department of Commerce.

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DECLINING PRICES AND BETTER PROFITS

Manufacturers faced with the problem of steadily declining price levels for their class of products encounter another problem in making as good a profit in 1927 as they did in 1926.

As prices go down under the stress of competition, the usual course is to hammer down production costs with the hope of at least preserving the same relative margin or percentage of profit per unit of sale. However, this usually means smaller actual money profit per unit, and the problem then becomes one of selling enough more units at the lower price to make the same annual net profit as before. This effort to increase sales volume may so add to a company's cost of doing business that the savings it makes in production are lost in the distribution of its product. In that case, even with the greater volume sold, net profit may not be as large as in previous years.

As a safeguard against smaller net profit, the bureau suggests simplification. It has been definitely proved in numerous instances that simplification reduces both the costs of production and distribution. It has likewise been definitely proved that diversification adds to both production and selling costs. Yet there are many manufacturers who believe the best way to get more business and to make more profit is to add another number to the line. Such a scheme would work out profitably more often if the manufacturer at the same time would drop or discard some slow-moving or seldom-wanted line number, even at the risk of not being able to supply it on an occasional order. The usual practice of striving for greater volume by adding new lines, meanwhile hanging on to all the old ones, soon makes the whole line top-heavy, and inventory rapidly piles up with items that do not turn over. Profits that would otherwise have been made on the live lines are absorbed in the costs of carrying the

dead ones in stock. As the variety increases the burden on plant facilities and the whole production personnel increases, and sooner or later manufacturing costs go up instead of down.

The selling organization is pushed to spread its effort over the expanded line, and the consequent diffusion of effort usually increases the cost of selling per unit of sale faster than it increases the total volume of units sold.

A minimum consistent range of line numbers, all active, carrying no dead weight, made and sold in large volume, even at a smaller cash profit per unit, means good annual net profits.

The manufacturer who can thus keep his production and selling forces "stripped for action"—the manufacturer who has the courage to "simplify" rather than "diversify"—need not worry about better profits in the face of declining prices.

REVISED SPECIFICATION FOR PORTLAND CEMENT

The United States Government master specification for Portland cement was revised June 10, 1927; copies of the specification now being available at 10 cents each from the Superintendent of Documents. There are several changes in the new test requirements. The 7 and 28 day tensile strengths have been changed from 200 and 300 to 225 and 325 lbs./in.^{2}, respectively, and the specific gravity test has been eliminated. Miscellaneous minor changes have been made in the methods of chemical analysis, as well as in the molding of the briquets. The pressure exerted during molding must now be maintained between 15 and 20 pounds. The conditions of storage have been made more definite. The temperature of the mixing water, moist closet, and water in the storage tank are to be kept at 21° C$\pm$3°. A few details of the type of testing machine to be used have also been given.

A NEW ACOUSTICAL PLASTER

A plaster which will absorb 10 to 15 per cent of the sound striking it will remedy the acoustical defects of most of the auditoriums, theaters, and churches having such defects. An investigation is in progress at the bureau with the object of developing such a plaster.

To absorb any appreciable amount of sound energy, a plaster must possess a porous surface of such a nature that the sound will peneterate into the plaster and be changed to some other form of energy. The hard, nonporous surface possessed by the ordinary sanded plaster or by the lime-gypsum white finish coat does not have this porosity; hence, practically all sound striking a plaster of this kind is reflected back into the room. This condition gives rise to the objectionable echoes and reverberations which are so often found in public buildings.

There are at present several acoustical plasters on the market which possess the desired property of porosity. With most of them this effect is produced by using a porous aggregate, such as pumice. It is necessary, however, with plasters of this type to use a very closely graded aggregate of fairly large particle size. This results in a somewhat harsh working plaster which is difficult of application and which must be applied with great care and considerable skill in order not to destroy the desired surface.

By adding small amounts of alum or aluminum sulphate and a carbonate ($CaCO_3$, for example) to the calcined gypsum-sand dry mix it has been found that a plaster may be prepared which possesses the desired characteristic of surface porosity and which may be easily worked and applied. When this plaster is wetted, the alum and corbonate react to form carbon dioxide, CO_2, which is entrapped in the body of the plaster in the form of countless minute bubbles of gas.

When the plaster is applied to a water absorptive backing, such as an ordinary scratch or brown coat of plaster, the excess water in the wet acoustical plaster is partially removed by the absorptive effect of the backing and the water films surrounding the gas bubbles are

broken, leaving a large number of communicating small pores throughout the plaster. These small gas bubbles also serve another purpose in increasing the ease of workability of the plaster and thus making it easier to apply.

Experiments have been made with many different types of aggregate in an effort to find the most satisfactory one for use. Among those investigated may be mentioned sand, pumice, raw and calcined diatomaceous earth, cinders, ground cork, asbestos, tufa stone (a volcanic ash), and several others. Of these pumice, calcined diatomaceous earth, and tufa stone produced the most satisfactory plasters. A plaster containing 2 parts granulated tufa, graded to pass a No. 14 and be retained on a No. 40 sieve; 1 part sand, graded from sieve No. 10 to sieve No. 30; and 1 part of calcined gypsum, to which was added 2 per cent by weight of the calcined gypsum of a mixture of calcium carbonate and potassium alum in molecular proportions, and retarder had approximately the sound-absorbing properties desired. It is possible to increase the percentage sound absorption by increasing the tufa: calcined gypsum ratio, increasing the tufa: sand ratio, or increasing the particle size of the aggregate. Certain details, such as the method of application, condition of backing, etc., are now being given consideration.

DURABILITY OF CONCRETE AGGREGATES

The durability of concrete aggregates when subjected to weathering is an important question confronting the users of concrete. The disintegration of rock is geologically attributed in great part to the action of alternate freezing and thawing. The actual freezing and thawing of test specimens to determine their fitness for concrete is a process of such length that accelerated tests are desired. Three such tests have been proposed—the alkali test, the sodium sulphate sodium chloride, and boiling and drying tests. The sodium chloride and sulphate tests consist in alternate cycles of soaking in the salt solutions and oven drying between 100 to 110° C.

Thirty-six varieties of the most common representative of coarse aggregate have been collected throughout the United States. These include three granite, 4 trap rock, 4 sandstones, 7 limestones, 6 slags, and 12 gravels, the last containing limestone, sandstone, granite quartz, glacial gravel, and slaty schist. The samples for treatment weigh 40 pounds, and individual samples of each variety are separately subjected to the sodium sulphate, sodium chloride, boiling and drying, and freezing and thawing tests.

The aggregate before testing was all screened to pass a 1-inch mesh, and to be retained on ¼-inch mesh. The grading of the individual samples was also determined as a check upon the amount of disintegration as determined by observation.

The aggregates are being analyzed to determine the stratification, texture, and mineral content. The apparent specific gravity, porosity, and cold-water absorption are also being determined. To date 24 freezing and thawing cycles have been completed on 28 varieties of aggregate and 40 cycles on all varieties in the three other treatments.

Of the types of aggregates used in these tests the limestones are apparently showing the greatest disintegration. The gravels are composed of such a variety of stone that disintegrated particles are found in almost all kinds of gravels, but with few exceptions by far the greater number of pieces are sound. Granites have not been affected, and only occasional pieces of trap, sandstone, and slags have shown signs of breaking up under these tests.

From the results obtained to date there seems to be very little or no relation between the various tests.

DURABILITY OF STONE

The selection of stone for the ordinary type of business structure or residence is usually made principally on the basis of cost and general appearance.

In selecting stone for more monumental structures the question of durability should be taken into consideration. It has been learned by experience that some deposits of stone which meet the usual requirements do not possess satisfactory resistance to the destructive action of severe climatic conditions. To construct of an untried stone a monumental building which is expected to endure for centuries, but actually begins to disintegrate within a few decades, is an expensive experiment.

In this country there are few stone structures which are more than 100 years old. Considering the types of stone so extensively utilized at the present time there are few structures built of them which have stood for a period greater than 50 years. While actual examples of stone structures which have stood for long periods are of the greatest value in estimating the durability of any particular stone, short periods of use have only a relative value in this respect. In order to gain more knowledge of the desirability of present-day building stone, this bureau is conducting experiments to determine the relative resistance to frost action of various types and deposits. Frost action tests, when carried to the point where the specimens are disintegrated, with many deposits of natural stone, require a considerable expenditure of time, and hence an important object of this research is to determine, if possible, a more simple means of predicting durability. A comparison of the frost resistance of many samples of stone with the usual physical determinations, such as strength, elasticity, porosity, absorption or relation of absorption and porosity, shows that while such properties may have a bearing on the subject of durability they do not afford a thoroughly reliable criterion for judging this property. A theory has been advanced that if a stone readily absorbs a volume of water greater than nine-tenths of its pore space it will not be resistant to frost action. This is based on the fact that water increases in volume by one-tenth in solidifying. The present research does not indicate that this theory is reliable. Considerable evidence has been developed that the relation of absorption to permeability is a valuable factor in predicting durability; that is, if the stone offers little resistance to the flow of water through its pores a high absorption may not be particularly undesirable.

A technologic paper will be available at an early date containing the results of frost action tests on the limestones of this country. Work is in progress on the commercial sandstones which will be made the subject of a similar report at a later date.

SOME FUNDAMENTAL PROPERTIES OF REFRACTORY CLAYS AT 1,000° C

Technical News Bulletin No. 120 (April, 1927) gave a brief summary of the results obtained in determining the elastic properties of each of 17 representative sagger clays at three temperatures ranging from room temperature to 925° C.

These data have been supplemented by further tests of the 17 clays at 1,000° C. It was found that all the clays showed plastic deformation or "set" at 1,000° C. under loads applied at the center of the 1 by 1 by 10 inch specimen bars. With a load of 30 lbs./in.^{2} the following plastic deflections were shown at midspan for a period of one-half hour (readings taken at five-minute intervals):

11 of the 17 clays showed plastic deflections close to and with an average value of 0.0001 inch.

3 of the 17 clays showed plastic deflections close to and with an average value of 0.0002 inch.

1 of the 17 clays showed a plastic deflection of 0.0003 inch.

2 of the 17 clays showed plastic deflections close to and with an average value of 0.0005 inch.

Determinations of plastic flow were also made using loads of 60 and 120 lbs./in.^{2}, and it was found that the plastic flow of the specimen clay bar was not proportional to the applied load. The modulus of elasticity of the majority of clays was found to be higher

at 750° C. than at room temperature, but at 1,000° C. all clays were much less rigid than at room temperature. The transverse breaking strength was greater at 1,000° C. for all clays except one. However, it is quite possible that a variation of the time-load factor would have an appreciable effect in reducing the resultant strength values.

The chemical analyses gave only a very general indication of the elastic-recovery and plastic-flow properties of the burned clays. This is probably because of the variation in flux constituents, some of which are undoubtedly much more viscous at 1,000° C. than others. The P. C. E. (pyrometric cone equivalent) of the clays appears to give a much better indication of the plastic flow at 1,000° C. The results indicate that, under the conditions of this test, all those clays having a P. C. E. of over 30 show little variation in plastic flow, while those less than 30 show a greater plastic flow (as a group), and the plastic flow of the several clays in the group is approximately inversely proportional to the P. C. E. values.

FURTHER INVESTIGATION OF FELDSPAR

Technical News Bulletins No. 117 (January, 1927) and No. 121 (May, 1927) summarized reports on the composition, fineness determinations, softening range, and true specific gravities of the feldspars used in this investigation; also the effect of feldspar upon the relative glaze fit, mechanical strength, volume shrinkage, porosity, and thermal expansion of vitreous and "semivitreous" bodies. A comprehensive report of the investigation was published in the Journal of the American Ceramic Society, Vol. 10, No. 6, June, 1927. The work is being continued by a study of the effect of feldspar upon the thermal expansion of vitreous and "semivitreous" bodies containing feldspars of varying alkali content ranging from high soda to high potash feldspar.

Thermal expansion observations were made by the interferometer method, using triangular specimens hand pressed in plaster molds and fired according to the firing schedule on page 11 of Technical News Bulletin No. 121. Two series of "semivitreous" bodies fired to cone 8, were made for comparison, using two different formulas, one developed by the bureau and the other suggested by the white-ware advisory committee. The data indicate:

1. A very noticeable increase in rate of expansion in the range 560 to 600° C. for specimens of all firings.

2. All bodies containing the high potash feldspar show the smallest percentage of expansion at 700° C. for all of the different rates of firing and cooling used. The expansion appears to increase in Na_2O content of the feldspar, the relation being affected, however, by the uncombined silica content.

Additional observations were made using two "semivitreous" bodies containing the highest soda and highest potash feldspars, respectively, fired to cones 4, 6, 8, and 10. The tests were made to determine the effect of increasing heat treatment upon the expansion. The data obtained, using the high soda feldspar, show the expansion to be practically the same for specimens fired to cones 4 to 6 and 8, but with those fired to cone 10 the expansion is appreciably lower (about 0.03 per cent). The expansion for the high potash bodies is highest when fired to cone 4 and lowest when fired to cones 8 and 10, with a difference of about 0.04 per cent.

TANNING WITH CHESTNUT WOOD EXTRACT

In connection with the preparation of standard leather samples for use in researches on acid in leather, interesting observations have been made on the nature of a straight chestnut wood extract tannage. Seven 50 to 55 pound steer hides were used which were delimed with a commercial enzyme bate until neutral to phenolpthalein. The hides were then introduced into liquors made from powdered chestnut wood extract of 0.3 per cent tannin content. The concentration of the liquors was gradually increased until after 20 days it reached 4 per cent, between which value and 5 per cent it was maintained for

20 more days. The tannage throughout was allowed to proceed in a natural manner without the addition of any acids or acid-forming materials. At the conclusion of the tannage the leather was washed, oiled, dried, sammied, rolled, and dried again. The average yield was 61 per cent, and the leather seemed satisfactory with respect to firmness, color, and thickness.

Observations on the hydrogen ion concentration of the liquors showed that the original solution of analytical strength had a pH value of 3.9. After the hides were introduced this value changed to 4.7 in three days, after which the liquors became gradually more acid through natural fermentation until the pH of the final solution was 3.4. The leather gave a decided alkaline reaction by the Proctor and Searle method for determining free mineral acid.

The analysis of the leather was as follows:

	Per cent
Water soluble material	12.81
Hide substance	44.25
Grease (petroleum-ether extract)	1.87
Moisture	13.38
Insoluble ash	.21
Combined tannin (by difference)	27.48
Degree of tannage	62.10
Total ash	.31

As reflected by the above analysis and the physical appearance of the leather, it has been demonstrated that satisfactory leather can be produced with the use of chestnut wood extract alone. This fact has no particular commercial significance, since the properties desired in finished leather require the use of other materials which are blended with the chestnut wood extract. The low water soluble and high degree of tannage characteristics shown by the above analysis make the material particularly suitable for heavy leather tannages.

WASTE MAIL POUCHES AS PAPER-MAKING MATERIAL

Recently the bureau investigated the paper-making value of worn mail pouches which have been declared unserviceable for postal use. Worn or damaged pouches are repaired in so far as practicable, but condemned ones and waste from the repair shop are mutilated into scrap and marketed as "junk" to the highest competitive bidder. The unavoidable treatment to which the pouches are subjected in train and station use causes them to become very dirty. Because of this condition the market price for the refuse material has been relatively low, although the cloth used in the manufacture of the pouches is a good grade of cotton duck. As a result the General Supply Committee, Treasury Department, requested the investigation with a view to securing a better price for the waste, as its paper-making quality was believed to be good.

The tests were made on a semicommercial scale under practical mill conditions. The equipment employed was that in general use in the experimental paper mill of the bureau. Caustic soda and lime-soda ash were the digesting agents employed in the boiling process to free the cellulose fiber from the noncellulose impurities. The usual commercial procedure was followed in the preparation of the stock and its subsequent conversion into paper. Measurements were made of the physical properties of the finished sheets and corresponding data on papers from new cotton duck and from sulphite wood pulp were included as a basis for comparison.

Clean pulp was obtained from the waste pouches, and the paper produced therefrom was stronger than that made from sulphite wood stock and compared favorably with many of the high-grade bond and rag writing papers on the market. This practical demonstration of the paper-making quality of the material resulted in increased revenue from its sale to papermakers, amounting at present to around $17,000 annually.

A detailed report of this work was published in Paper Trade Journal, May 12, 1927.

NEW PUBLICATIONS

Additions to Supplementary List of Publications of the Bureau of Standards (beginning July 1, 1926)

Scientific Papers[1]

S548. Wave-length measurements in the arc and spark spectra of zirconium; C. C. Kiess. Price, 5 cents.

S549. Wave-length measurements in the arc spectrum of scandium; William F. Meggers. Price, 5 cents.

Technologic Papers[1]

T338. Color in the sugar industry: I. Color nomenclature in the sugar industry; II. Colorimetric clarification of turbid sugar solutions. H. H. Peters and F. P. Phelps. Price, 20 cents.

T346. Electrodeposition of chromium from chromic acid baths; H. E. Haring and W. P. Barrows. Price, 15 cents.

Circulars[1]

C325. Ceramic properties of some white-burning clays of the eastern United States. Price, 20 cents.

C327. Selection and care of garden hose. Price, 10c.

United States Government Master Specification for:

C33 (4th ed.) Portland cement. Price, 10 cents.

C82 (3d ed.) Raw linseed oil. Price, 5 cents.

C89 (3d ed.) Paint, white, and tinted paints made on a white base, semipaste and ready mixed. Price, 5 cents.

C93 (3d ed.) Iron hydroxide and iron oxide paints. Price, 5 cents.

C94 (3d ed.) Black, semipaste and ready-mixed paints. Price, 5 cents.

C165 (2d ed.) Olive drab (semipaste and ready mixed) paints. Price, 5 cents.

C323. Cement, plastic magnesia (magnesia-oxychloride), used as flooring bases, wainscots, etc. Price, 5 cents.

C330. Boiled linseed oil. Price, 5 cents.

C331. Chrome yellow (lemon, medium, and orange; dry, paste in oil, and paste in japan). Price, 5 cents.

C335. Hard fiber sheet packing. Price, 5 cents.

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Miscellaneous Publications[1]

M96. Organizations cooperating with the National Bureau of Standards. (Available free upon request to Bureau of Standards.)

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[1] Send orders for publications under this heading, with remittance, only to Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 25 cents per year (United States, Canada, and Mexico); 40 cents (foreign).

[2] "Outside publications" are not for distribution or sale by the Government. Requests should be sent direct to publishers.

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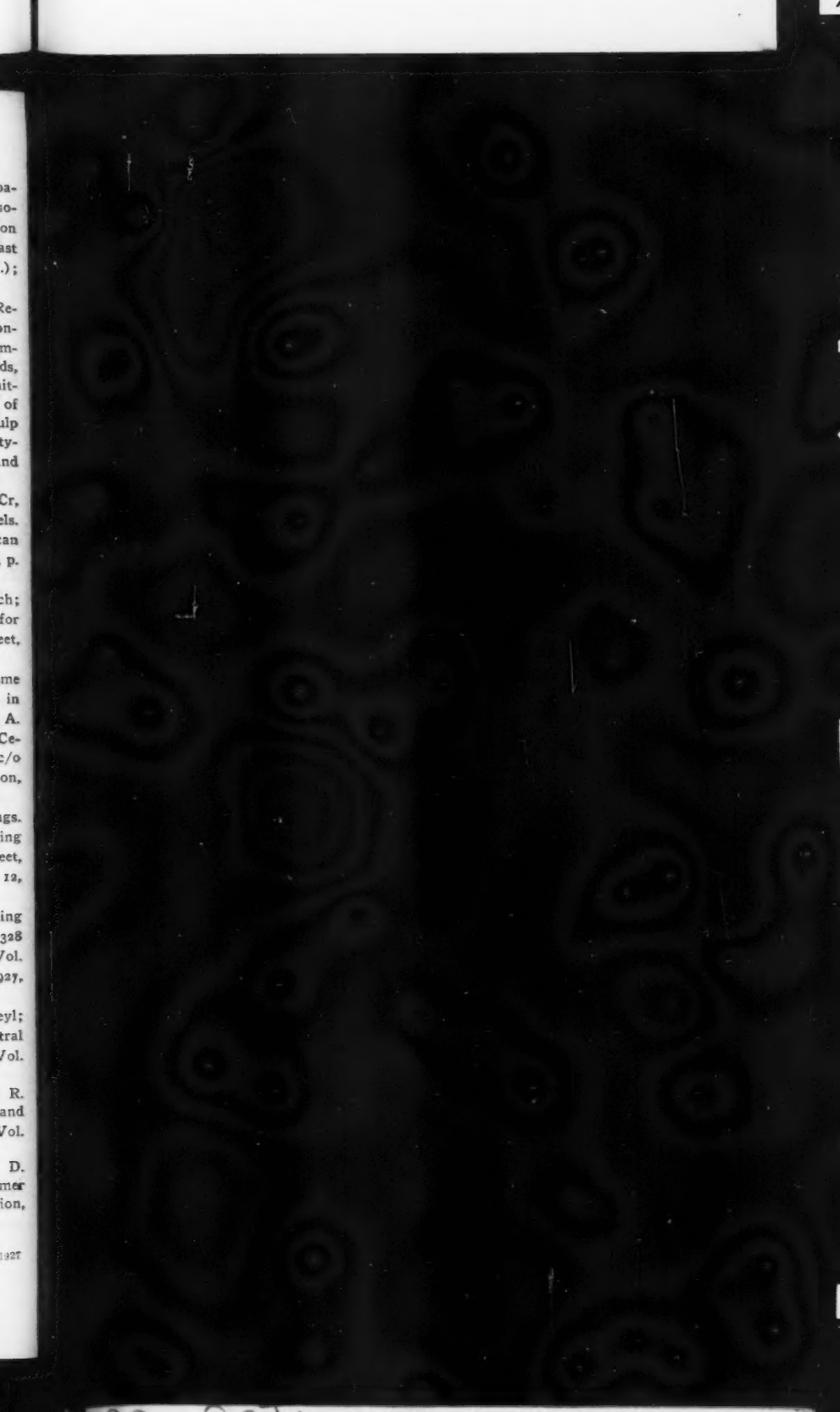
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